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ABSTRACT

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ABSTRACT

The purpose of this project was to employ philosophical research techniques to examine current issues in science education as a means of assessing the efficiacy of philosophical enquiry for educational research. The study indicated that speculative philosophical analysis is uniquely appropriate for initial enquiry into broad problems to examine basic objectives, generate new ideas, and/or illuminate additional options that may be compatible with the essential purposes and ideals of an institution, agency, or group prior to the commitment of time and resources to a particular course of action. Because it functions outside the discipline or subject to which it is applied, for example, philosophical research does not require the disruption of an enterprise to examine whether change is justified. Therefore, philosophical enquiry is a logical and essential first step in the search and research for justifiable alternatives in time of educational change.

PHILOSOPHICAL ANALYSIS: A FUNDAMENTAL DIMENSION OF EDUCATIONAL RESEARCH

Introduction

Philosophical enquiry is an established investigative methodology, and the National Association for Research in Science Teaching (NARST) lists it as one of the forms of research recognized by that group. It is atypical, however, of the empirical or quasi-empirical methods that characterize most educational research. Consequently, its unique qualities are unfamiliar to many educators, and it is sometimes confused with other forms of enquiry such as historical, naturalistic, futuristic, or correlational research. An explication of philosophical enquiry and a discussion of its application to issues in science education is presented below to demonstrate its relevance for educational research in general.

Explication of Philosophical Enquiry

Philosophical enquiry functions to examine purposes, justify fundamental assumptions and concepts, and illuminate options that are compatible with the aims and ideals of an institution, agency, or group. Ideally, it is a means for putting complex problems in the proper perspective to determine if change is appropriate prior to commitment of resources and time to a given course of action. This research methodology is unique in that it does not require disruption of an enterprise to examine options. Therefore,

it is especially appropriate for initial research into broad educational issues such as the concept of general scientific literacy, the relationship of science to technology and society, and the origins and purposes of science education.

There are three major types of philosophical investigation: normative inquiry; analytical investigation, which is sometimes called "critical analysis;" and speculative studies, or "synthetic philosophy." Normative studies have as their end the justification of value judgements about what individuals, societies, and/or institutions may aspire to do. Generally, ethical and aesthetic questions constitute the predominant focus of this category of research.

Critical analysis and speculative studies aim to extend the limits of current human knowledge. Analytical investigations, which constitute the majority of contemporary philosophical activity, function to analyze and clarify the assumptions and concepts upon which conclusions may be based. Speculative enquiry, on the other hand, seeks to expand the boundaries of knowledge by synthesizing the conclusions of a field or fields of study and then filling in the gaps with speculation, or reasoned conjecture.

Philosophical enquiry, like any methodology, has essential functions and strict limitations. It does not function to advocate action, cause change, predict, prophesy, or to modify the world. It functions to help put problems in the proper perspective so that it will be easier

"to grasp better what reasons are good reasons for changing or for keeping things as they are" (Hirst and Peters, 1970, p. 131). It is a systematic way to see if change is appropriate.

Philosophical research does not function within a discipline. Rather, it functions to think about that discipline. It is therefore an inappropriate method of solving problems in education, or in history, or in science, or in religion, or in anything else. Each discipline has its own unique epistemological system and problem-solving traditions for that purpose. Philosophical methods are essential, however, when an institution, agency, or group needs to take a detached look at, or think objectively about, what it is doing to see if its anticipated or actual ideas or actions are reasonable and compatible with its basic purposes and ideals. In other words, philosophizing about a profession's goals can help to illuminate and justify alternatives that the group may reasonably consider; but which options to choose and what actions to take are decisions that must be made, generally by consensus, within that profession.

Theoretical parameters, hypothetical constructs, and too-explicit goals are contrary to the nature of philosophical enquiry. Research goals must be general, the procedures open, and the scope of enquiry unfettered by disciplinary bounds to allow maximum opportunity for reflection, imagination, inspiration, and discovery. The

investigation should begin, proceed, and conclude as much as possible without hinderance from prior supposition. For instance, "if you . . . insist that all things must have something in common, you have gone at it backwards. First, find that common trait, then talk about it" (Reid, 1971, p. 7). Finally, in keeping with the other characteristics of philosophical study, research conclusions should be as general as possible.

Philosophy may therefore serve two unique and essential functions: the examination of fundamental standards and concepts; and the justification of basic goals. Whether it be an educational objective such as scientific literacy, or a scientific postulate such as the theory of evolution, or a sociocultural ideal such as excellence in education, or a relativistic perception of the nature of history, or a religious perspective of human destiny, or whatever, there are undergirding concepts and presuppositions that the supporting community generally accepts, largely without question, as the basis for its support. Such basic concepts, or ideas, are the intellectual tools of a profession; and philosophical enquiry is a systematic means of examining those tools and how they are used, to determine if that support is justifiable.

Philosophy constitutes a means of stepping back, so to speak, to make a detached assessment of an enterprise with regard to its overall purposes and its relation to basic social values and cultural norms. Generally, however,

philosophical evaluation of the basic concepts and standards that undergird a profession is not typical of day-to-day operations. Consequently, many professionals are unaccustomed to that sort of activity. This is not a problem, a philosopher noted, so long as the need for philosophical assessment is not ignored or forgotten:

> It is only natural and right that people should be more interested in using concepts. . . than examining them. They are, after all, intellectual tools and the worker who spends all his time improving his tools never gets his work started. Usually there is no great need to examine basic assumptions and basic concepts, just as usually most tools function well. But occasionally in all work, whether it is manufacturing or thinking, something goes wrong with the tools, and work on the job has to stop and work on the tools begin.
>
> (Reid, 1971, p. 12)

Implications of Philosophical Analysis for Science Education

Scientific and technological development have produced an unprecedented rate of cultural change over the past several decades, and society is becoming continually more dependent upon science. Since the mid-1950s, the educational profession has been expected to produce a scientifically competent citizenry capable of maintaining a science-oriented civilization. There has been growing concern,

however, that this goal is not being realized. Rather, there is widespread agreement that science education is in a condition of crisis (Harms and Yager, 1981; Johnston and Aldridge, 1984) and there is intense pressure for reform (Hurd, 1986). In any situation, Kuhn (1970) noted, the claim of crisis indicates a need for philosophical investigation. Presaging Reid's industrial analogy, he concluded that "the significance of crises is the indication they provide that an occasion for retooling has arrived" (p. 76).

From that perspective, a philosophical assessment of the basic concepts of science education is indicated to see if they are the right tools for the job and to see if they are being used well. However, like all fields of education, science education is committed to action; and the work must go on. Presumably, Broudy (1973) implied, there exists a contract between the science education community and the public--"the contract to teach science" (p. 227). Unlike many enterprises, then, it is generally neither convenient nor appropriate to "stop the work" to retool for reform in science education. However, the very definition of "reform" implies, if not mandates, change; and "change" implies a shift from one position, course, or direction to another, perhaps one radically different.

Because philosophy does not function within an enterprise, it is not necessary to interrupt the teaching effort to seek and evaluate reasonable options for reform. Philosophical research is therefore an essential first step

in responding to the current crisis in science education. When there is no crisis, no pressure for change, philosophical analysis may not be needed; in fact, its use could even be counterproductive. In times of change, however, it is essential to the clarification and justification of options that are compatible with accepted cultural and professional norms. This research methodology therefore enables the science education community to continue to meet its contract to teach science to the best of its ability under current conditions while simultaneously seeking and evaluating reasonable options for improvement. Once such options are justified, it may then proceed to select the more promising options and test and develop them as indicated, hopefully with minimum risk and disruption, and continue with the business of teaching.

Reflecting on the history of science education, however, Hurd (1982) observed that "considerable attention has been given to the . . . pragmatics of our field, but only minimum attention to its philosophical underpinnings" (p. 281). In fact, he declared, "there seems to have been a selective inattention in our journals to philosophical discourse" (p. 281). Consequently, science education lacks such a philosophically defensible basis for responding to the pressures for reform that have characterized the 1980s.

Science education faced a similar challenge in 1957 when Russia lauched the first artificial satellite, Sputnik. In the United States, science education was denounced as a

failure; and over five billion dollars was spent to reform science teaching (Harms and Yager 1981). Soon, however, there was serious doubt that many of those reforms were justified. The editor of The Science Teacher illuminated the crux of the problem in 1961:

> All of us are caught up in the "pursuit of excellence but all too often, the pursuit becomes a mad rush to "do something," even though we are not sure that it is right." . . . We seldom take the time to think and spell out what is meant by excellence.
>
> (Carleton, 1961, p. 4)

Before we can judge success or failure, he continued, we must have some established standards of excellence and "clear notions of what our objectives are" (Carleton, 1961, p. 4). That was a philosophical challenge to be sure that the enthusiastic actions of the 1960s would not be misdirected. It was not heeded.

Nearly three decades later, the pursuit of excellence in science education continues, still largely without adequate criteria for ascertaining its success or failure; and leading science educators continue to decry the hazards of attempting to operate an educational enterprise without adequate attention to philosophical justification of its courses of action.

As science educators attempt to deal with the declared crisis of the 1980s, they face many of the same basic questions that confronted the profession in the late 1950s

and '60s, still to be answered. "These are the days of judgement, when schools at all levels are called upon to render an accounting," Broudy (1973, p. 227) warned: "Suppose schools promise, or allow the client to believe they promise, what . . . they cannot deliver" (p.227). Another science educator echoed that concern:

> In addition to considering what goals are proper, we must consider what goals are possible; in devising strategies to accomplish goals, we must not lose sight of real barriers that limit our activities.
>
> (Herron, 1981, p. 104)

Implicit in those comments is a challenge to the science education community to carefully examine its fundamental goals and principles--to clearly define what it is the profession stands for. A review of the literature in science education, however, revealed many unresolved issues of a basic philosophical nature. For instance, what is the basic purpose of science education? Is it to produce scientists and technologists, or to produce general scientific literacy, or both? Is it to teach science as it is known and practiced by modern scientists, or as it relates to the social condition, or some combination of these, or something else as yet unimagined?

What sort of qualifications do science teachers need? Do schools need the same curriculum for science majors and non-majors alike? What is scientific literacy? Is it a

reasonable and realistic goal? How may science be taught to achieve it? What sociocultural factors must be considered? There is fundamental disagreement on these issues.

What is the nature of science? Do most science textbooks present a reasonably correct picture of science? Kuhn (1970) presented convincing evidence that they do not and in fact cannot.

What sort of curricular materials are needed for science education? Who should develop them? In the early '60s it was presupposed that having scientists head up the development of curricula was the key to better science teaching, and science education was commited to that end--a commitment that proved to be very questionable. A careful philosophical review of that presupposition might have significantly altered the history of education in the United States over the next quarter-century.

Efforts toward scientific literacy seemed to be based on a similarly questionable notion that the public should learn the scientific language, principles, and concepts necessary to understand and appreciate science. Would it be just as legitimate to speculate that, if the need for increased public understanding of science is essential to the well-being of both science and society, the scientific community should learn to disseminate its information in a manner that is relevant, comprehensible and useful to the general public?

Philosophical research is especially suited for probing

into evasive questions such as "why aren't we achieving scientific literacy," or "what is the nature of science," or what should we teach? In retrospect, it is clear that many commitments of educational resources over the past quarter-century were based upon well-meaning but philosophically unfounded assumptions of what science educators should strive for. In a study of the basis of science teaching, for example, Robinson (1969) examined more than 100 papers that had been identified as relevant to that topic; but "most of the papers were judged to lack sufficient philosophical orientation and analysis to warrant reviewing" (p. 468). This is still largely the case, according to Hurd (1982, 1986), and science educators attempting to plan for the 1990s consequently face many of the same basic issues that confronted the profession in the late 1950s.

Those unresolved issues may critically affect the research hypotheses and conclusions upon which future educational research and practice will be based. Consequently, the philosophical resolution of such questions is of fundamental importance to the profession, lest it inadvertently risk committing itself to ineffectual action and unwarranted expenditure of resources on the basis of unfounded concepts and principles.

Since the voting public is the final arbiter of the allocation of public resources for any enterprise in a democratic republic, neither science nor science education

can afford a continuing erosion of public confidence and support. Nor can the nation afford a failure to attain and maintain the levels of scientific personnel and public appreciation of science that are necessary to nurture a science-oriented culture. Consequently, it is critical to the destinies of both science and society that the basic issues of science education be examined and clarified in a timely and effective manner to insure that future efforts in science education will be appropriate and productive. Examination and clarification are the hallmarks of philosophical enquiry. Therefore, philosophical research is essential to provide a sound basis for the concepts and assumptions upon which the science education profession must ultimatley justify its research and development.

Conclusion

Because many of the issues facing science educators are generic to education, philosophical analysis will be equally essential across the educational arena. What, for example, is the basic purpose of education in general. It is enculturation, or vacational preparation, or intellectual enrichment, or all or some combination of these and other factors? There is widespread disagreement on this.

What sort of curriculum is appropriate for education in the 1980s and '90s? How and by whom should curricular objectives be determined? There has been much debate about "back to basics." Which subjects constitute the "basics" of a sound education as society approaches the twenty-first

century? Who should structure and evaluate the curricular materials? Subject-matters experts? Teachers? Parents? Learning psychologist? A review of almost any major newspaper, news magazine, or newscast will reveal examples of the widespread controversy surrounding these issues.

What qualifications should be required of teachers? What sort of preparation is needed to bring teachers to those qualifications, once they are determined? By whom and upon what standards should the criteria for assessment of teacher competency be established? Who should prescribe the type of training programs that should be provided for teachers? The National Education Association? State or Federal lawmakers? Citizens groups? The Holmes Group? What should teachers be expected to do, or not do, with regard to student discipline? This controversial issue was the subject of the cover story in a major international news magazine (Time, pp. 52-57, February 1, 1988).

What should be required of students for advancement and graduation? How should students be evaluated? How equitable are national testing programs? An exhaustive listing of major issues of this nature would require many volumes, and all are critical to the direction of educaton. For each issue of this nature that is involved in educational policy and practice (and sooner or later, all are), some position must be assumed as the basis for decision-making and resources allotment. Education could not function without such assumptions, and the destiny of education and the

society it nurtures are critically related to the soundness of those suppositions. Among the most critical decisions for education today is whether its theorists and practitioners will take advantage of the opportunity that philosophical enquiry provides for reflective analysis of its purposes and objectives--whether they will take the time to justify the basic concepts and principles upon which they base their concepts to be sure they are the right tools for the job, and to be sure that they are being used properly.

It must be clearly understood, of course, that like other research methods, philosophical analysis is not a panacea. Furthermore, "the totality of cultural changes in the United States over the past decade has raised questions about the policies and practices of nearly all disciplines related to public well-being" (Hurd, 1982, p. 281-282). Because of the culturally relevant nature of educational problems, many of the more persistent issues may defy resolution in a world of rapid social and cultural change. Still, philosophy is useful for helping to deal with even those evasive issues. The history of education in the United States is typically one without systematically attained consensus regarding such educational problems; but philosophy offers an avenue for increased understanding of the nature of those problems, which may illuminate avenues for consensus among concerned citizens:

> "The philosophical community functions as the harbor and refuge for problems, whatever

their real character, which are homeless and wandering, and . . . many of the problems of educators at the present time are of this nature.

(Levison, 1974, p. 8)

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